

# OCEAN OF THINGS



## ABOUT OCEAN OF THINGS

DARPA's Ocean of Things (OoT) program seeks to enable persistent maritime situational awareness over large ocean areas by deploying thousands of low-cost, environmentally friendly, intelligent floats that drift as a distributed sensor network. Each drifter manages a suite of commercially available sensors to collect environmental data such as ocean temperature, sea state, and location as well as activity data about commercial vessels, aircraft, and even marine mammals moving across the ocean. The floats transmit processed reports when needed via satellite to a government-owned cloud network for storage and real-time analysis. Data from this floating distributed network will support Department of Defense missions as well as public oceanographic research and commercial applications.

## BENEFITS OF THE PROGRAM

Ocean of Things passively collects all of its information. Of the types of information discussed above, one example benefiting marine mammals is acoustic data collected at a fine spatio-temporal scale that may be able to detect, identify and track marine mammals and quantify background noise-scapes. This information can then be used to improve our understanding of marine mammal behavior in regional basins. The program will also develop algorithms to automatically detect, track and identify nearby vessels, as well as the identification of new indicators of anomalous maritime activity such as illegal fishing behaviors.

Planned environmental capabilities include measuring sea-surface temperature over a large region, mapped with sufficient density, to better understand ocean currents and mixing. Combined sea surface measurements can be used together with remote sensing data to build more accurate regional models of primary productivity and potential distributions of marine organisms for improved management of marine resources and fisheries. These in-situ sensor measurements are also critically important for calibration of satellite measurements. For example, field observations improve the accuracy of satellite-derived chlorophyll in-ocean color sensors, linking in-situ measurements to processes within the water column below.

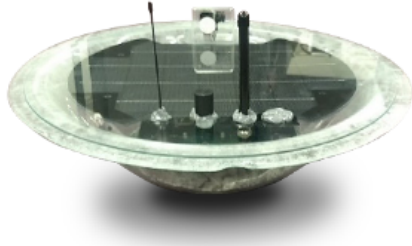
The OoT system incorporates this information and provides users a modern platform to support dynamic, relevant and more efficient ocean management. This paradigm shift away from terrestrial-based management techniques (e.g., quota-based systems tied to stationary marine protected area boundaries) has been proposed in numerous marine sectors but so far has lacked sufficient accessible real-time data about changes in the ocean environment. With the addition of advanced data analytics, OoT will automate many processes that previously required human analysts.

## FLOAT DEPLOYMENT LOCATION & SCHEDULE

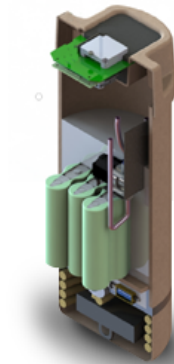
An at-sea deployment of floats is planned for the first quarter of 2020 off the coast of Southern California and in the Gulf of Mexico. The government management team is leading multiple companies through agile software development and commercial manufacturing efforts. Design and development are supported by extensive ocean-modelling efforts and engineering tests to preview the sensor data and float behaviors.

## FLOAT HARDWARE

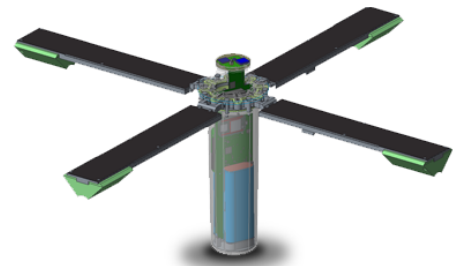
The program is developing three types of environmentally compliant drifters to house passive sensors that can survive in harsh maritime environments. Each float will monitor its surroundings for up to one year before safely scuttling to the ocean floor. The floats are made of biosafe materials, pose no danger to vessels, and comply with all federal laws, regulations, and executive orders related to protection of marine life.



*Glass housing*

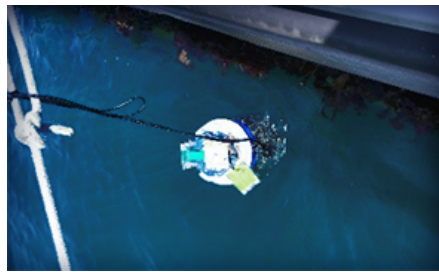


*Cardboard housing*



*Aluminum & wood*

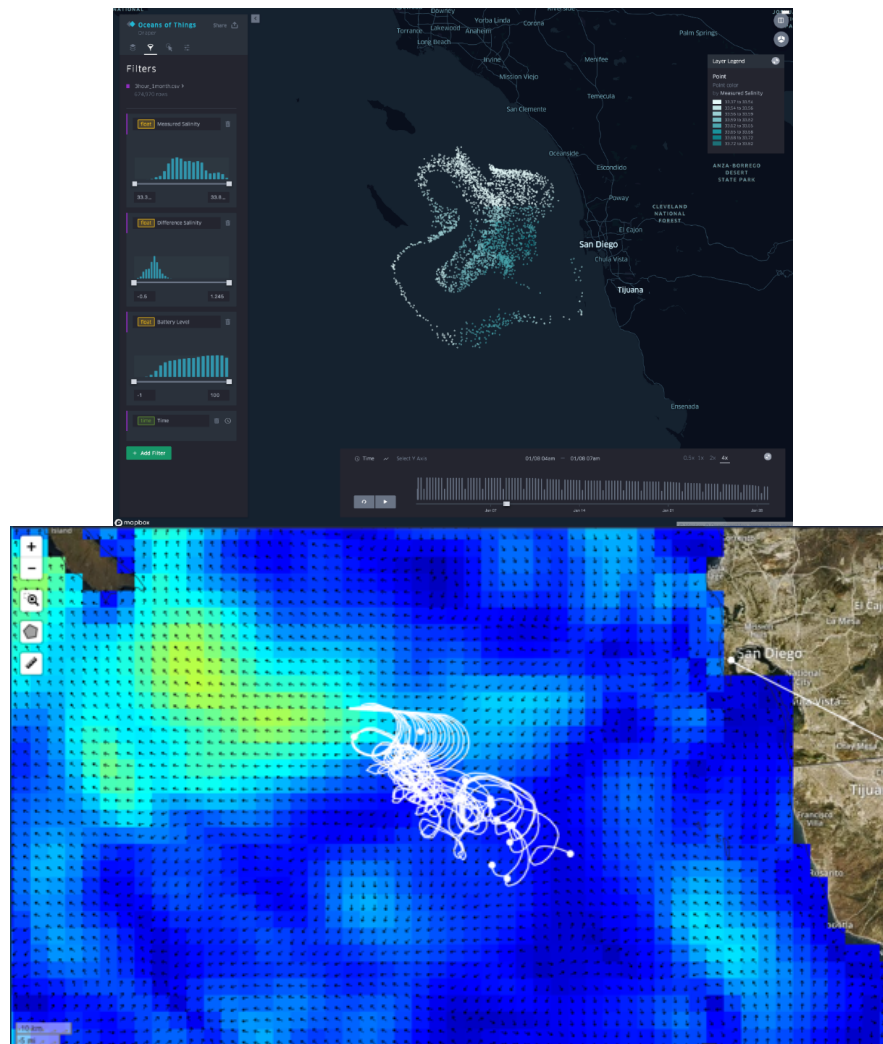
## FLOATS DURING IN-WATER TESTING



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## 1. FLOAT REPORTS. DATA FOR ANALYSIS

The data analytics portion of the Ocean of Things program has developed cloud-based software and analytic techniques to process data collected by floats. This software can dynamically display float locations, health, and mission performance; process environmental data for oceanographic and meteorological models; automatically detect, track, and identify nearby vessels; and identify new indicators of maritime activity. Predictive modelling of surface currents and wind within the deployment region informs initial deployment and periodic additions to ensure area coverage.



## ENVIRONMENTAL INFORMATION AVAILABLE FOR DOWNLOAD

Environmental data is now **available to download**.

Additional data products may become available as the program progresses. Those products will also be made available on **this page** on future updates.

## IF YOU FIND A FLOAT

Floats are designed to sink to the bottom as they approach the experiment's geographic boundary. In the unlikely event a float doesn't sink and is found, please follow the steps below to return or properly dispose of the float:

Take a picture of the float and upload it via the barcode on the float label.

Return the float to the ocean if found at sea. This will enable the float to continue supporting research.

If found on shore, please contact DARPA at the phone number on the float label to facilitate return or disposal.

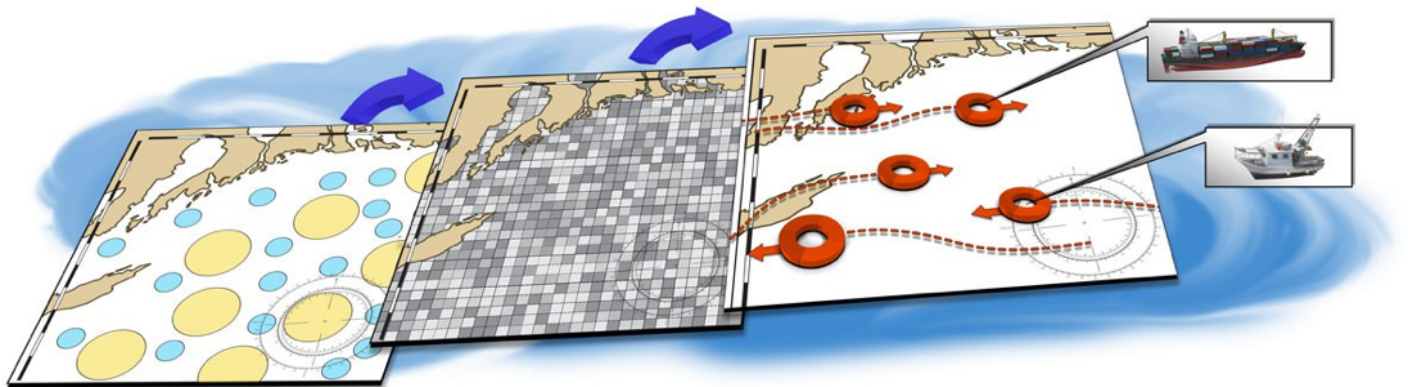
## SIGNUP FOR INTEREST

For more information about Ocean of Things, please write to us at [oot@darpa.mil](mailto:oot@darpa.mil).

## ABOUT DARPA

For more information about DARPA visit: <http://www.darpa.mil/about-us/about-darpa>.

We look forward to improving situational awareness of the ocean environment and marine mammals!



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